

RHIC CNI Polarimeter Vacuum Issues

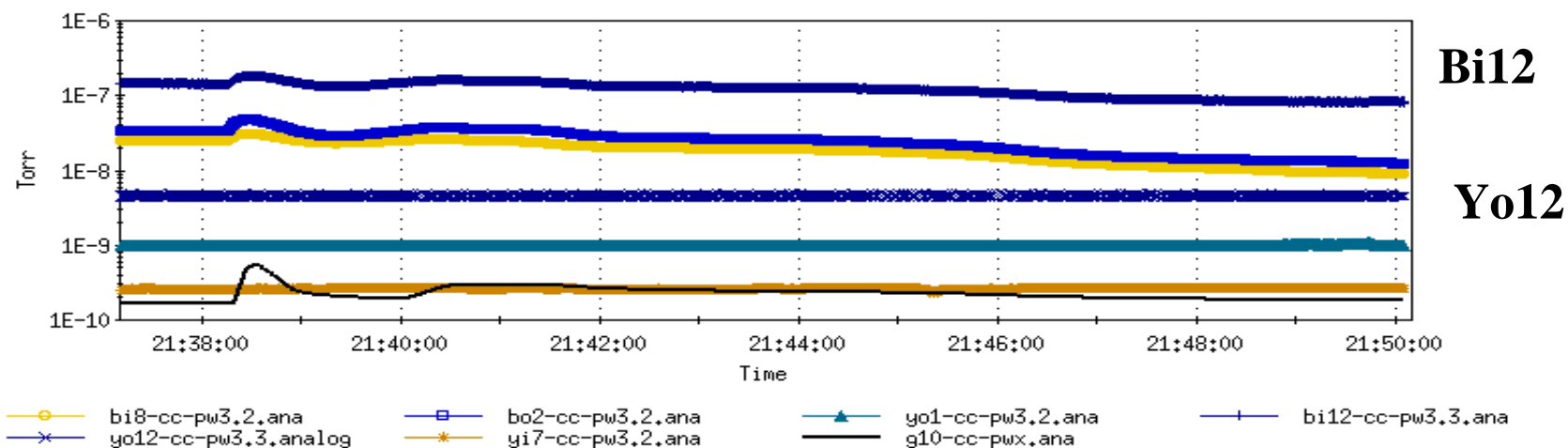
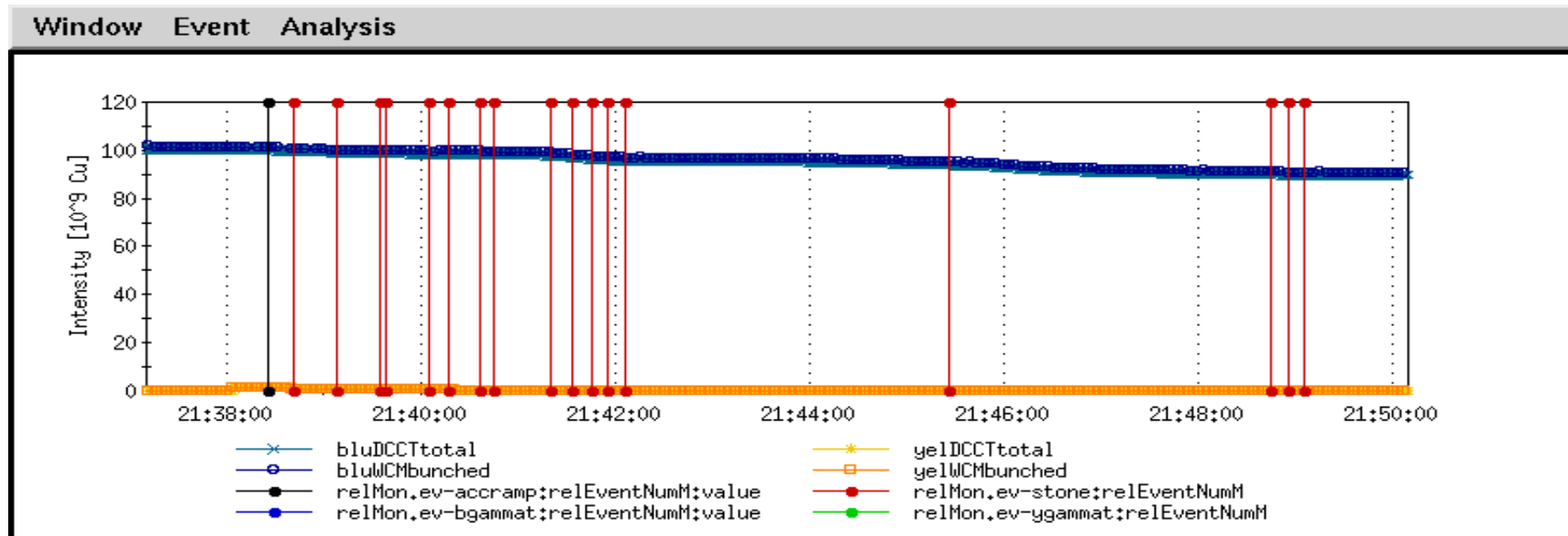
AGS Cold Snake Status

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RHIC Retreat05
June 16, 2005



Pressure of 110 bunch Ramp



Could not filter data from all of the requested scalar files. Continuing...

Status

- 110x0.92x10¹¹ ramp has been done and no run away pressure rise at bi12.
- Yellow targets have shorter life time than blue. Suspect that this may related to beta squeeze at IP12 which may benefit blue but hurt yellow (bi12 and yo12).
- Vacuum access is needed to replace targets and cause down time of ~10 hours and total intensity has to be limited after this.
- After four weeks of pumping down, the vacuum level in CNI polarimeter chambers is around 10⁻⁹ level. It is the worst region for pressure rise but not a problem for 110 bunch with bunch intensity 10¹¹. It may create problem for future higher intensity.

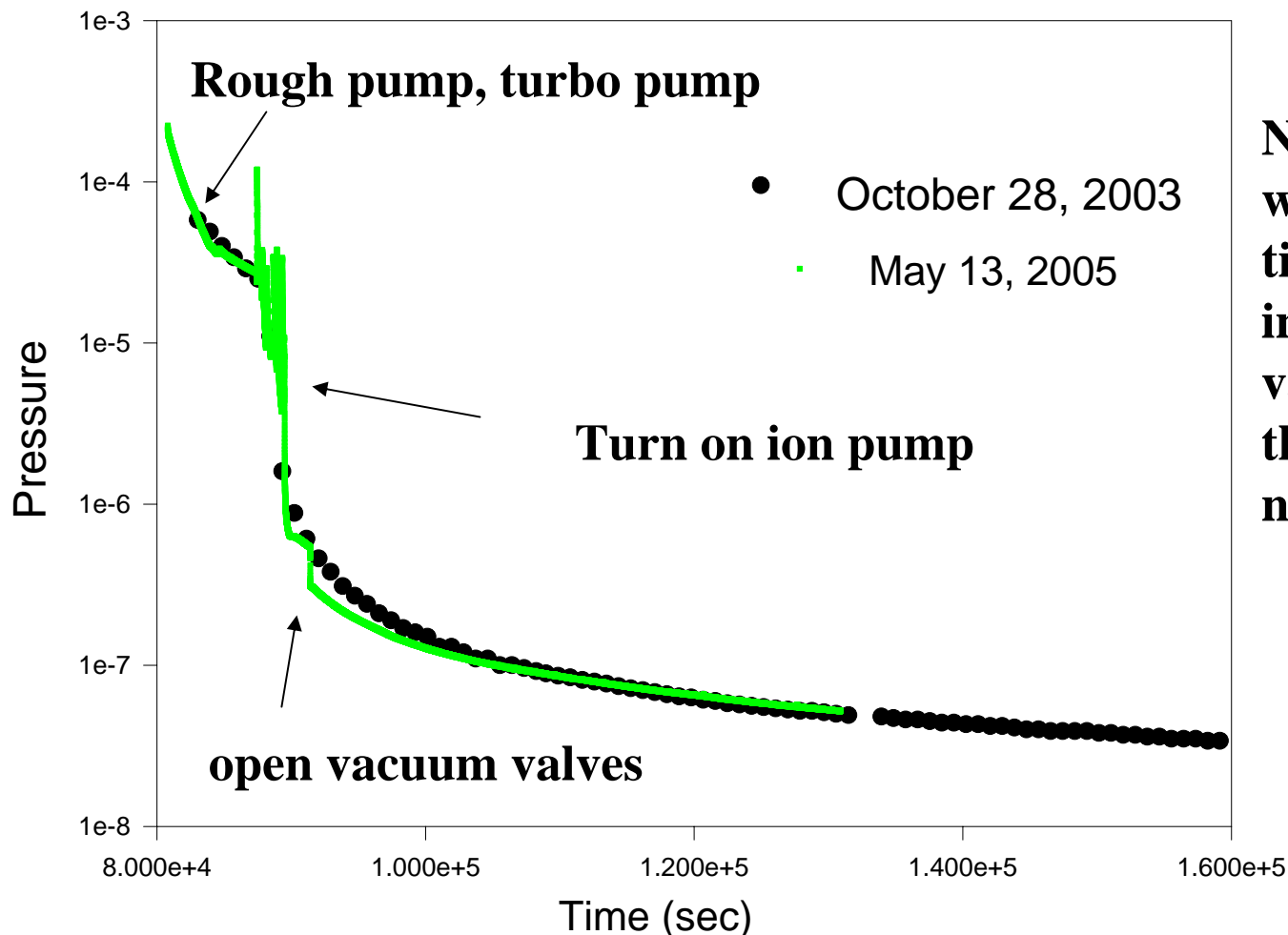
C Target Issues

- A new target production mask was purchased and still under testing. It did not work as expected then we switch to the old mask.
- A set of “good” targets were put in last October. The opening of target chamber at end of March damaged most targets (in the air over night). Then we are in a desperate mode to put what we have into the ring several times.
- The targets have to be replaced several times this run. However, the recent targets shows longer life time (>4 weeks), which would be enough to cover a run if we know how to select them.
- Increase acceptance (increase # of Si detectors) can increase target life time. But it is a redesign of the chamber.
- Target in the beam 4 sec. then data taking starts. Need to reduce this time in summer.

Can We Replace the C target?

- Unpolarized jet target (Anatoly)
 - Currently pol. Jet gives 20% error bar in 2 hours with 50×10^{11} . With unpolarized jet, it can provide 25 times more density. We can reach 3% error in four hours. NOT fast enough but can be a complimentary polarimeter.
 - Use C target only to check polarization at inj. and beginning of store. Use jet to give average polarization of each store.
- Unpolarized pellet target (Sandro)
 - It is estimated as minutes of measurement with full luminosity to get statistical errors. Very expensive, not near term solution (2-3 years). This may be a better solution for higher energy running, where the current C target is really a problem (too bulky).
- Advantage: no Si detector lifetime issue. No need to open the vacuum.
- Long term projects, expensive.

Vacuum Pressure Now and Then



Note: Vacuum valves were not open in this time scale in 2003, indicating worse vacuum property of the detector assembly now.

Solutions for Long Term Pressure

1. Target quality control: we are establishing the correlation of target parameters with the life. We need to build a good stork of targets so we can choose the best to put in. **Make the target production a high priority.**
2. Bake (150C) is effective to solve problem 2 and get vacuum level down quickly. Need a test. The effect is gone if open the chamber for target installation. **Not practical.**
3. A outgasing test and infrared heater test will happen before the end of run to determine any offending part. Search for better glues, materials.
4. Beam scrubbing. A test will be done in the last day of run5.

Solutions for Fast Pumping Down

1. To solve the first problem, we can redesign the chamber and add a smaller chamber (load-locker). A vacuum valve will separate this small chamber from the bigger polarimeter chamber. Due to the smaller size, the pump down can be faster. Drawback: expensive, redesign of the chamber, and target position track. Unlikely to be ready for next run.
2. Target quality control: we are establishing the correlation of target parameters with the life. We need to build a good stock of targets so we can choose the best to put in. **Make the target production a high priority.**
3. Add turbo pump to the chamber. Modify the setup to add a turbo pump. With remote control, this can reduce the access time by one hour in addition to the faster pump down.
4. Infrared heater to bake up to 90C to speed up pump down after target replacement. **Likely happen in the shut down.**

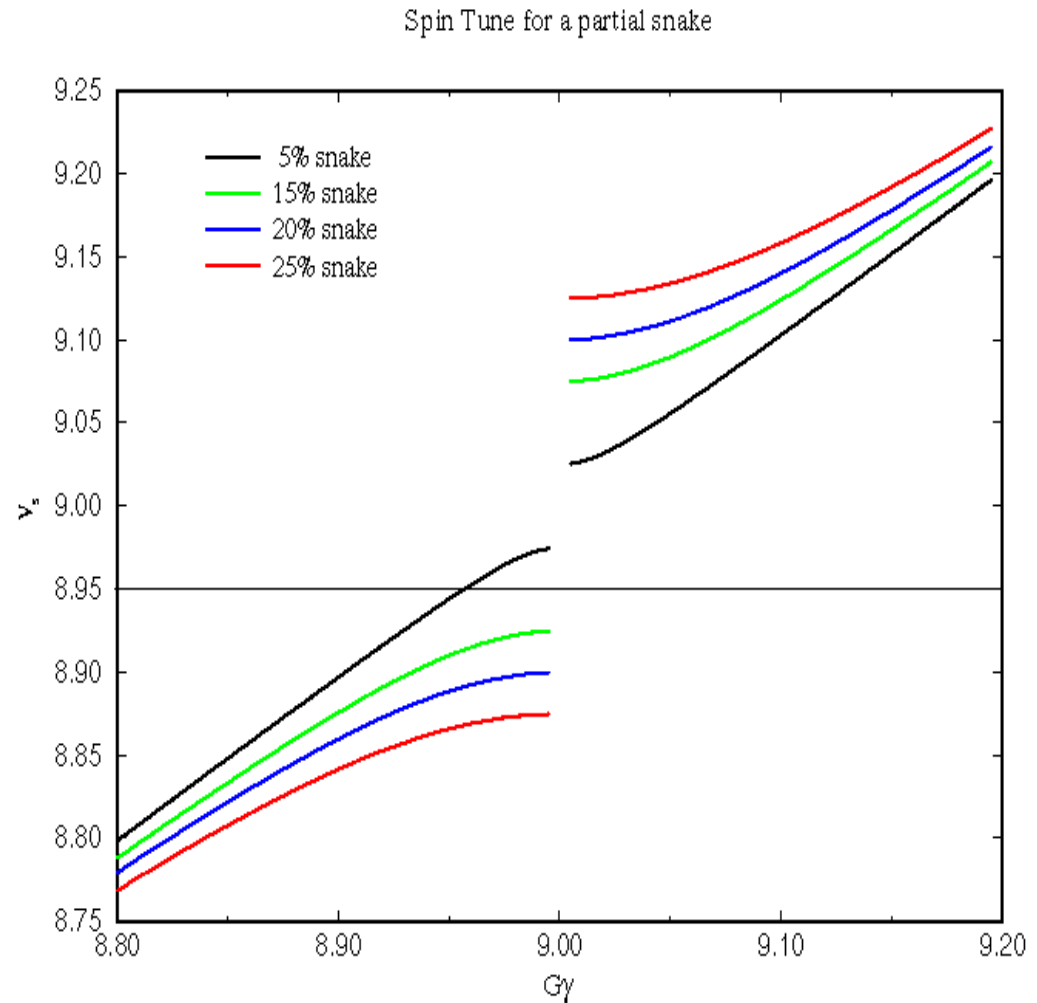
Summary

- better quality control in target can reduce the number of chamber opening;
- redesign the chamber can reduce the pumping time needed for each opening;
- infrared heater can help pumping down faster to restore vacuum level; adding pump is helpful.

Strong Partial Snake for AGS

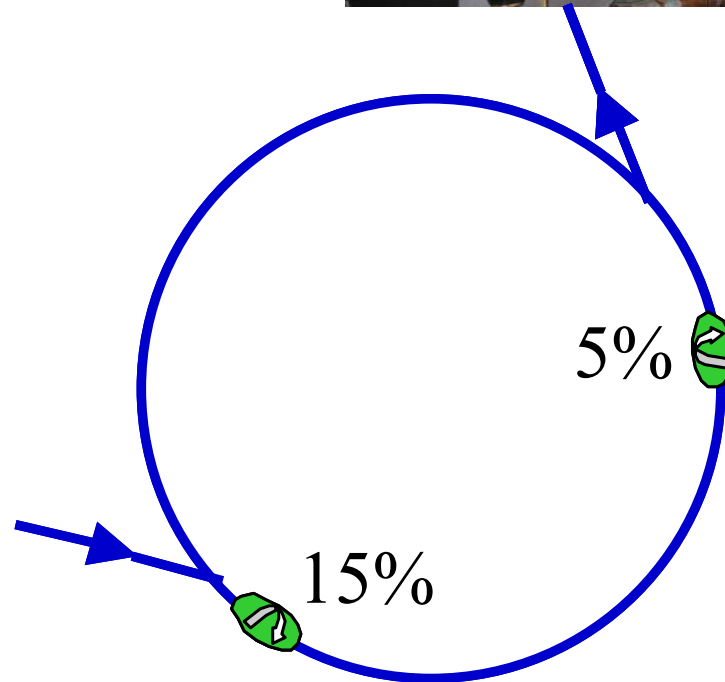
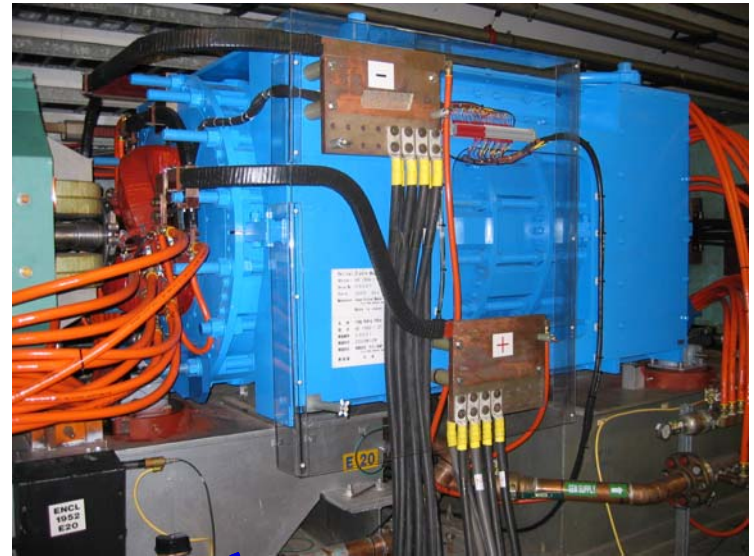
- A strong partial Siberian snake generates large spin tune gap for $G\gamma=N$. With strong enough snake gap is large enough to cover both imperfection and intrinsic spin resonances.

- Note: With a strong snake, the stable spin detection will deviate from vertical direction (18 degree for 20% snake).



AGS Cold Snake Installed

The two-snake solution provides better spin match at injection and extraction.



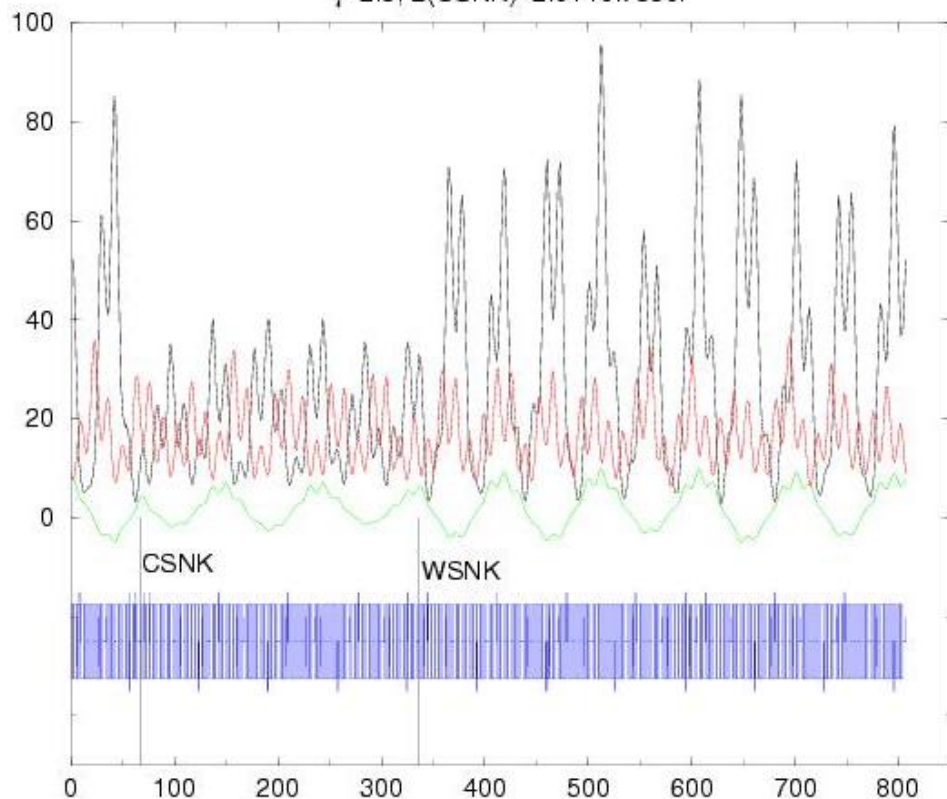
Haixin Huang

Lattice Function with Two Snakes

With the lattice distorted so much, it is not possible to push tune at injection close to 9. We have to ramp it up during energy ramp.

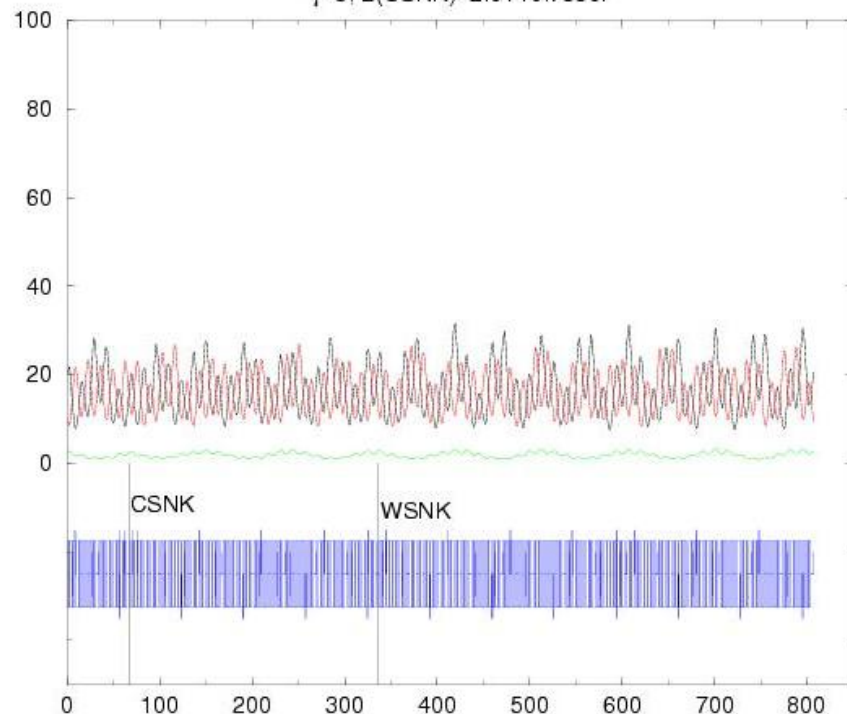
At Injection AGS – 2S 2QW

$\gamma=2.5$, $B(\text{CSNK})=2.0T+0.75s\text{ol}$



AGS – 2S 2QW

$\gamma=5$, $B(\text{CSNK})=2.0T+0.75s\text{ol}$



ALL 050613-02

At First Intrinsic Resonance

(Done by Alfredo)

Cold Snake Timeline

- March 31: Cold snake installed in the AGS ring.
- April 27: Quench test at 200A.
- May 3: First time to run 1.5T cold snake.
- May 4: Quench test at 290A.
- May 5-20: Commissioning the 1.5T cold snake at injection.
- May 18: Fixed the heat leak problem (burst disk, valve change).
- May 21: Commissioning the 2T cold snake at injection.
- May 22: Commissioning the 2.5T cold snake at injection.
- May 31: 2.5T cold snake at $G\gamma=12.5$, >60% polarization measured.
- June 2-13: 2.5T cold snake at $G\gamma=46.5$, ~50% polarization measured.
- June 14: 2T cold snake at $G\gamma=46.5$, ~50% polarization measured.

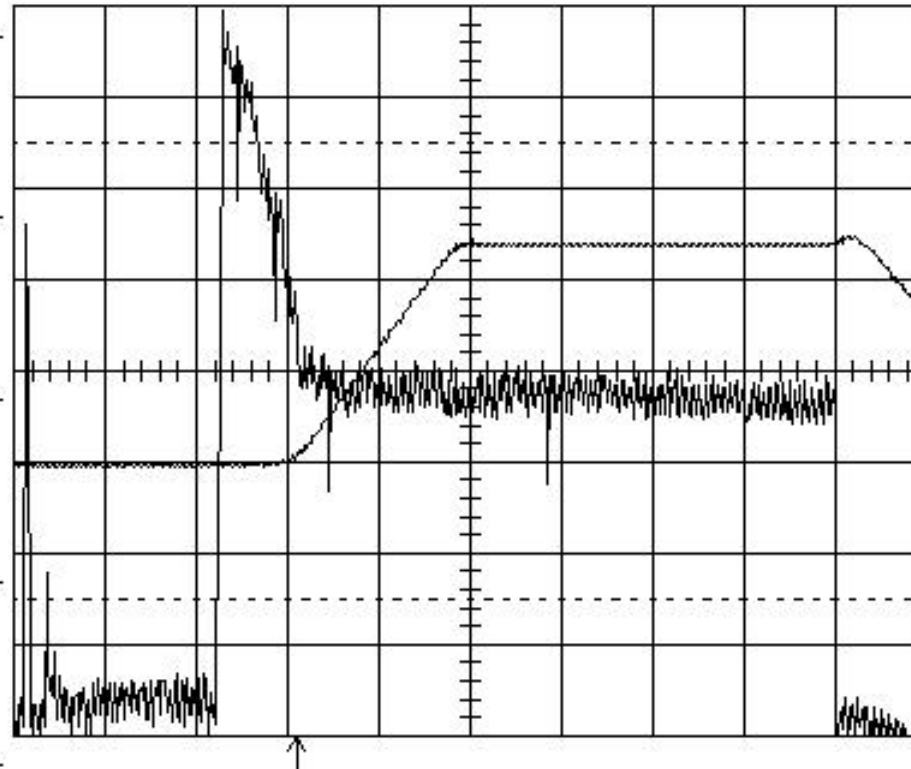
Commissioning the Cold Snake

- Due to the partial snake resonances, the available tune space is reduced to about half. So the vertical tune has to be put above the half of the tune space. Consider some tune spread, we want to push it higher by another 0.01 unit.
- In addition, the snake strength varies with energy. It is crucial to put vertical tune higher at the weak snake strength case.
- With tune close to integer with the strong snake at injection is not possible (not a stable machine). We have to ramp up vertical tune during the energy ramp. The estimation is that vertical tune should be in the tune window by $G\gamma = 7$ (injected at $G\gamma = 4.5$).
- Reached polarization of 50% with 6×10^{10} with 10% cold snake.

More beam at flattop (6×10^{10})

15-Jun-10
21:48:24

Main Menu



Chan 2
.2 s 2 V

EXT/10 2.0 V DC

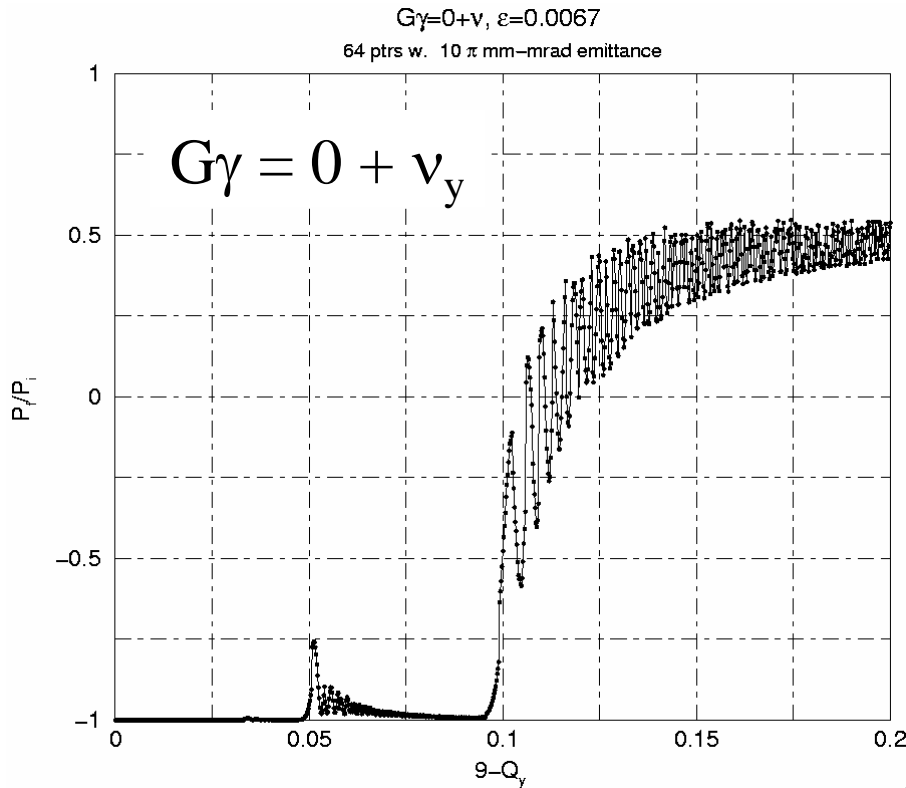


CH1 2 V
CH2 2 V
CH3 .2 V
CH4 .2 V

Chan 4
.2 s .2 V

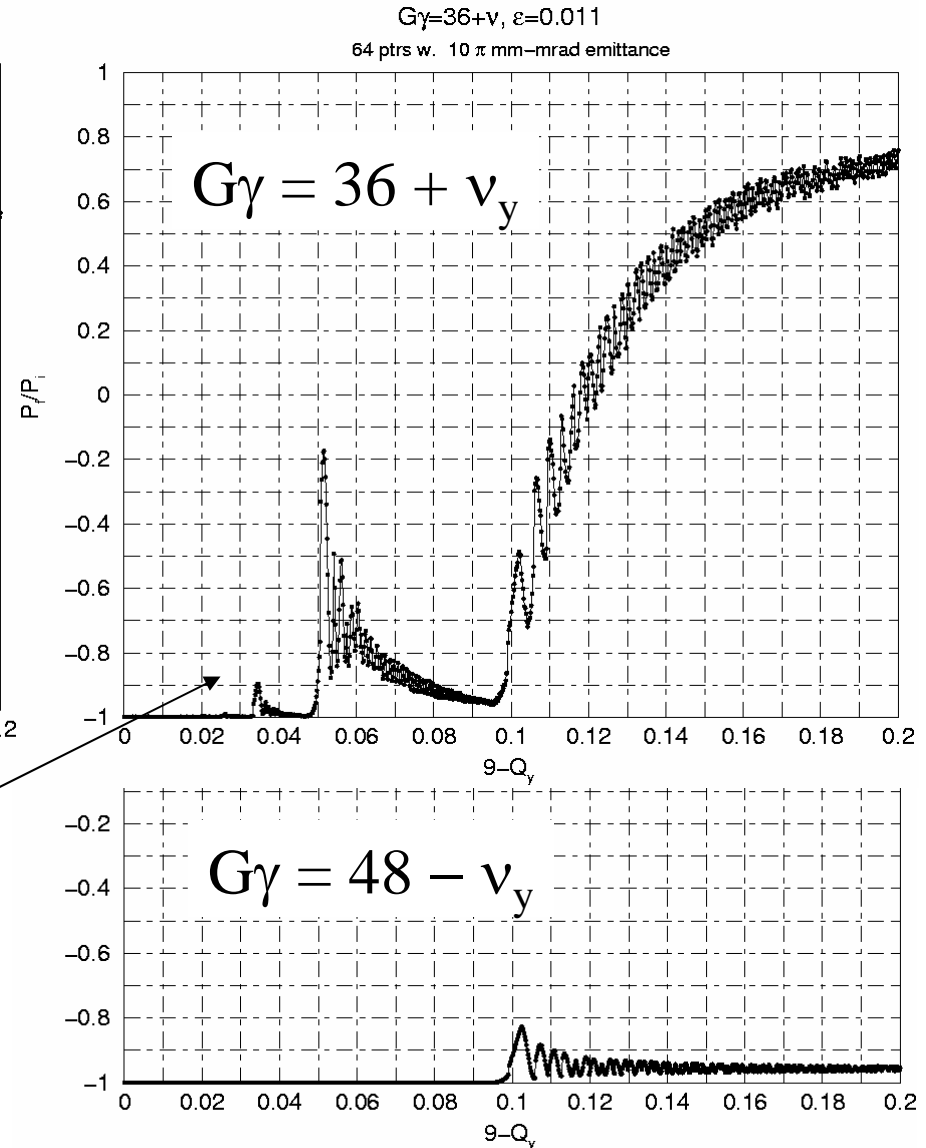
T/div .2 s

Modeling of AGS resonances with 20% Snake

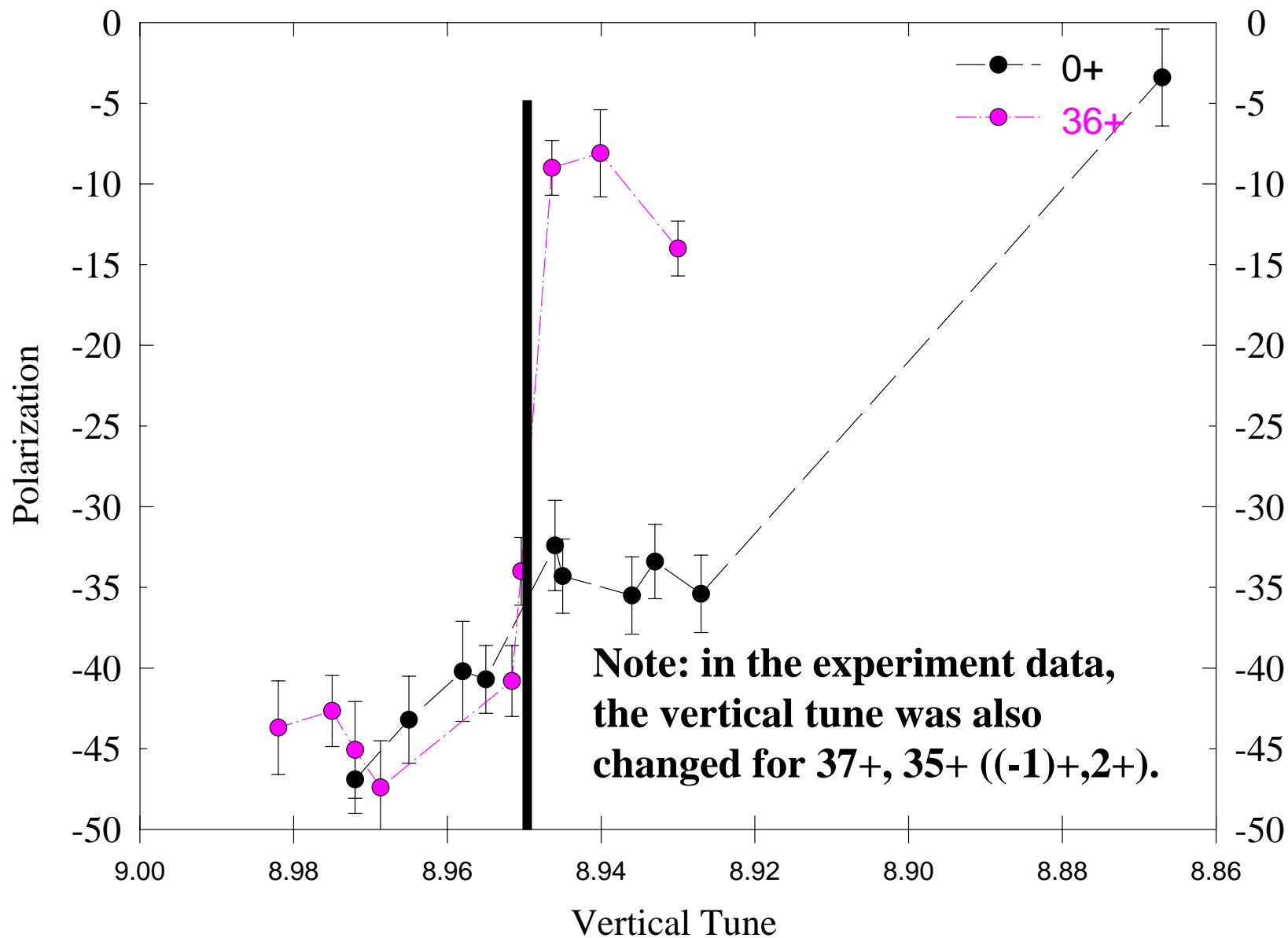


“Partial Snake Resonances”
 if $v_{sp} = n v_y$

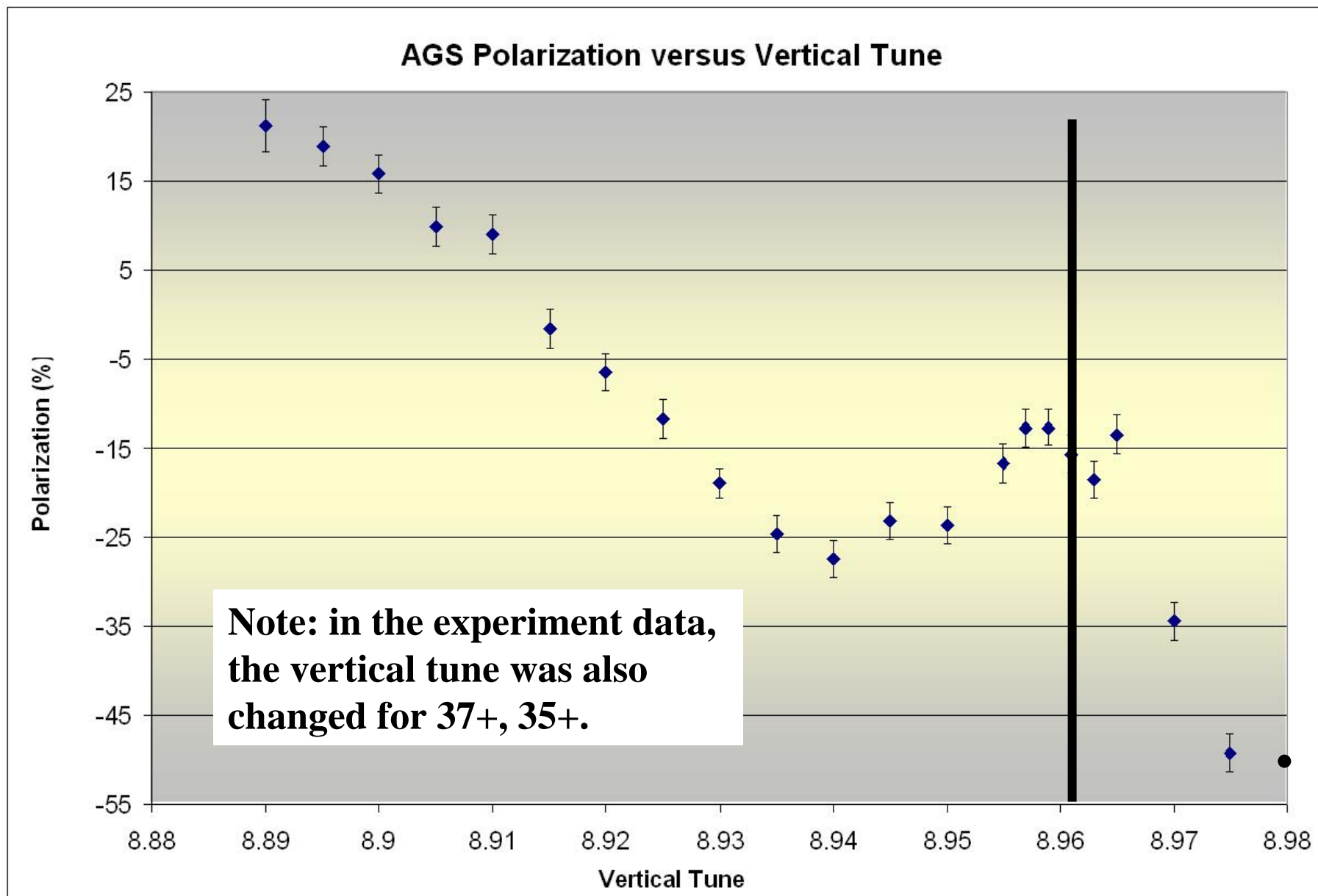
(done by Mei)
 16



Polarization at $G\gamma=46.5$ (15%+5% snake)



Polarization at $G\gamma=46.5$ (10%+5% snake)



Plans

- The experimental data already show that multiple strong snake idea works. The rest of time will be spent to see what is needed to bring the intensity and polarization to the level of RHIC needs (first step is more intensity).
 - Correct orbit to get more beam through.
 - Check the tunes before 0+. Will raise vertical tune fast enough to avoid $1+\nu$.
 - Measure polarization as function of vertical tune at various strong intrinsic resonances.
 - If the cold snake is ready for next run? We hope to give a better answer at the end of next week.

Team members who have been taking shifts for months: Leif, Kip, Waldo, Woody, Nick, SteveT, Haixin, Kevin.